(No Model.)

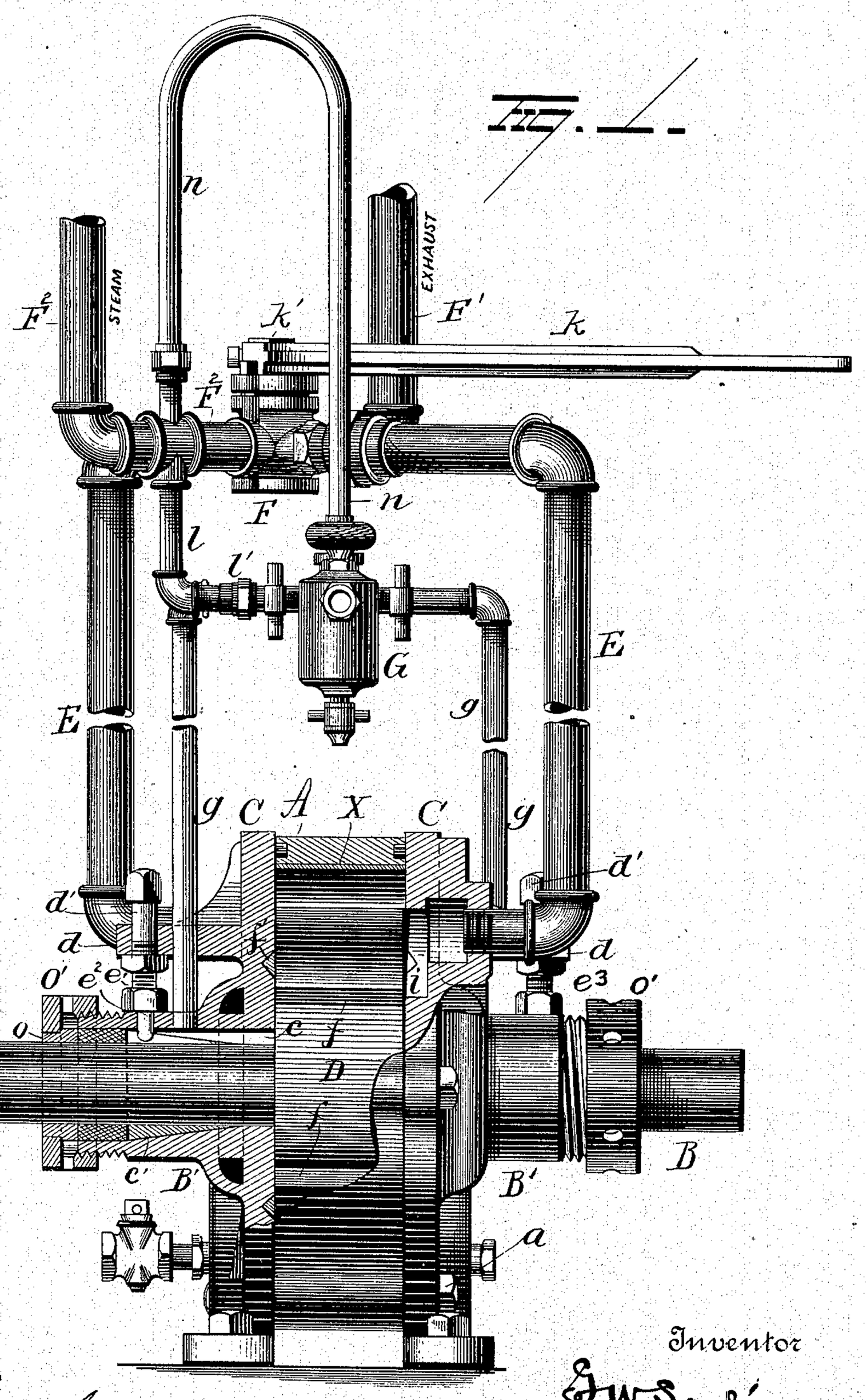
3 Sheets—Sheet 1.

G. W. SOULÉ.

ROTARY ENGINE.

No. 560,760. Patented May 26, 1896.

Fig. 1.



Witnesses
E. C. Nottingham
G. F. Dorring.

Inventor
G. W. Soulé.
By R. A. Burnham.
Attorney

(No Model.) 3 Sheets—Sheet 2.

G. W. SOULÉ.

ROTARY ENGINE.

No. 560,760. Patented May 26, 1896.

Fig. 2.

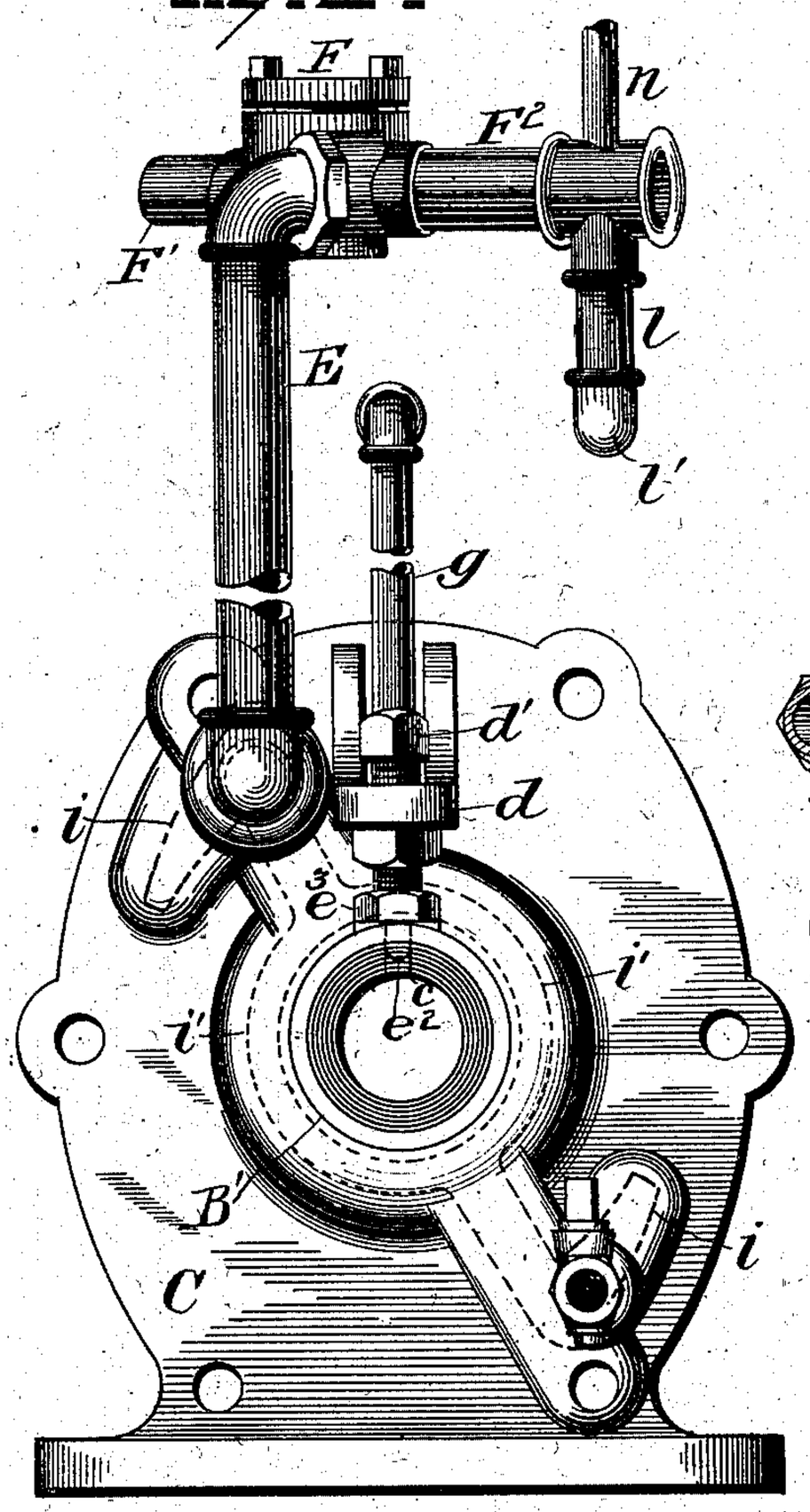
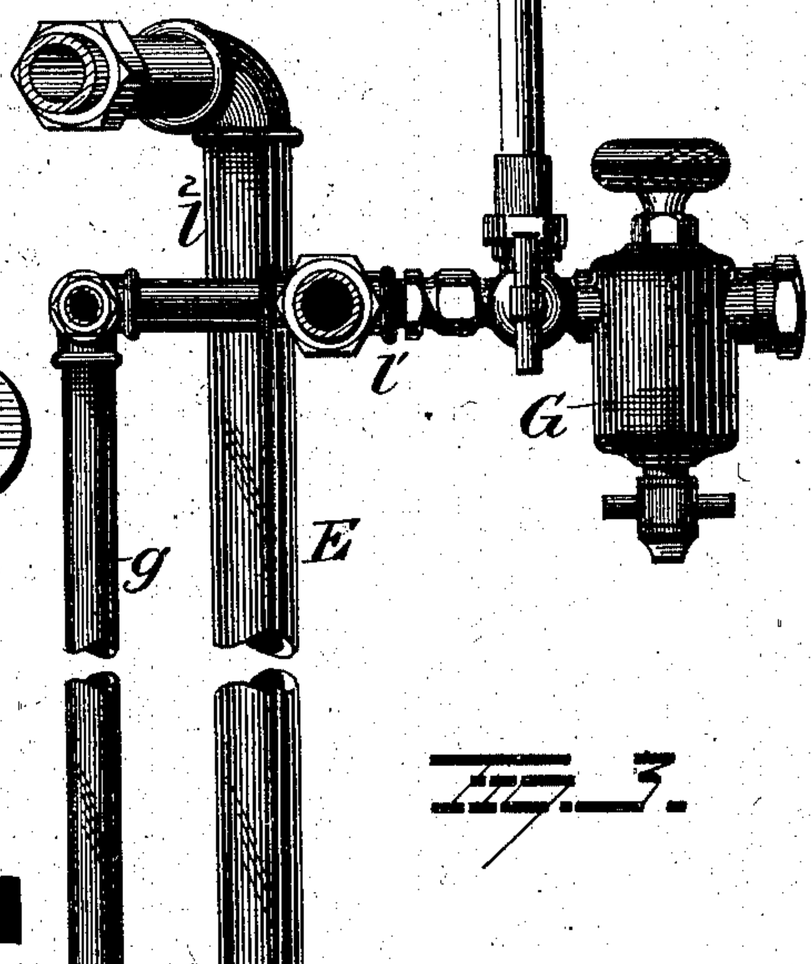
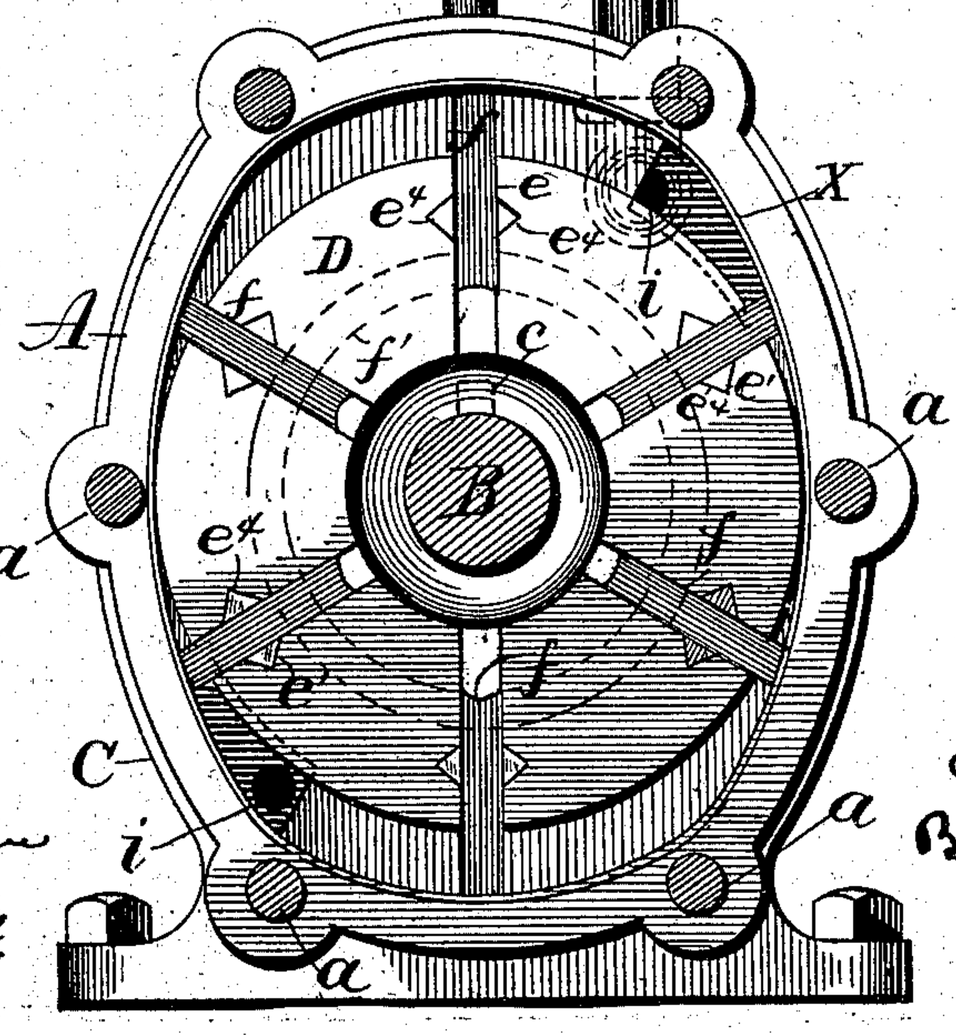


Fig. 3.





Witnesses
E. Nottingham
G. F. Downing.

Inventor
G. W. Soulé.
By H. A. Seymour.
Attorney

(No Model.) 3 Sheets—Sheet 3.

G. W. SOULE.

ROTARY ENGINE.

No. 560,760. Patented May 26, 1896.

Fig. 4.

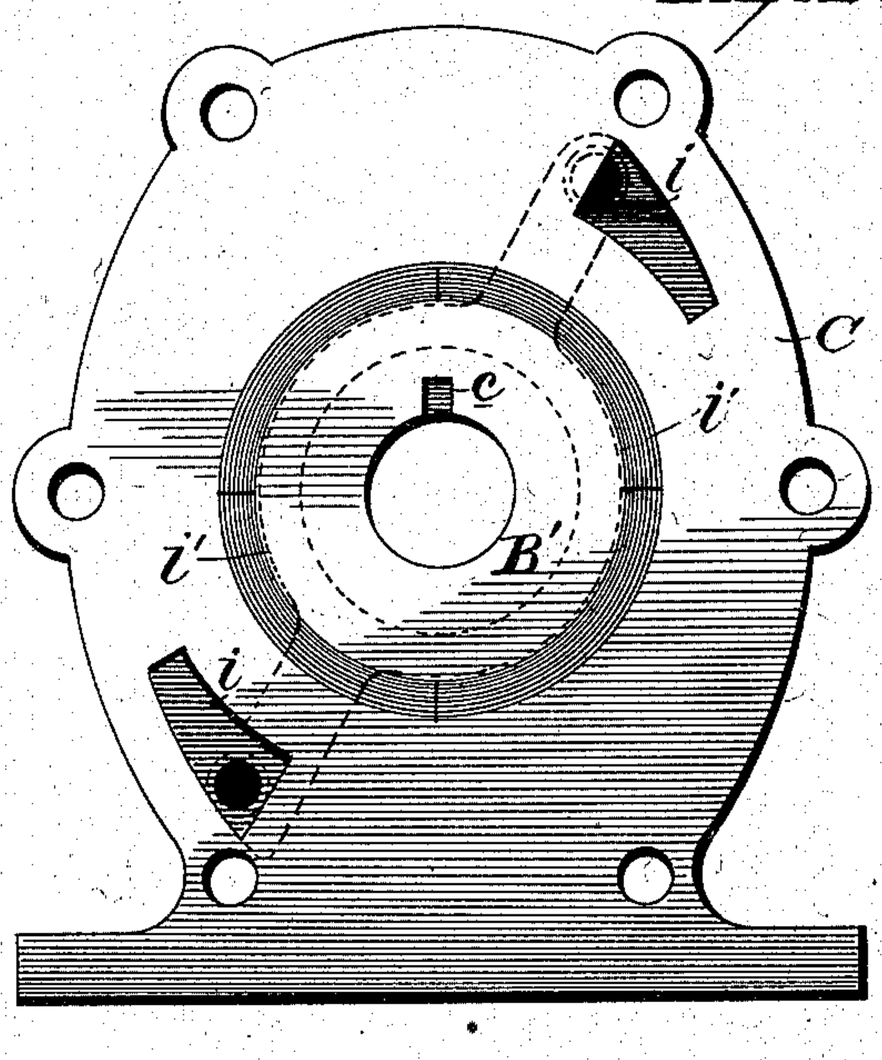


Fig. 5.

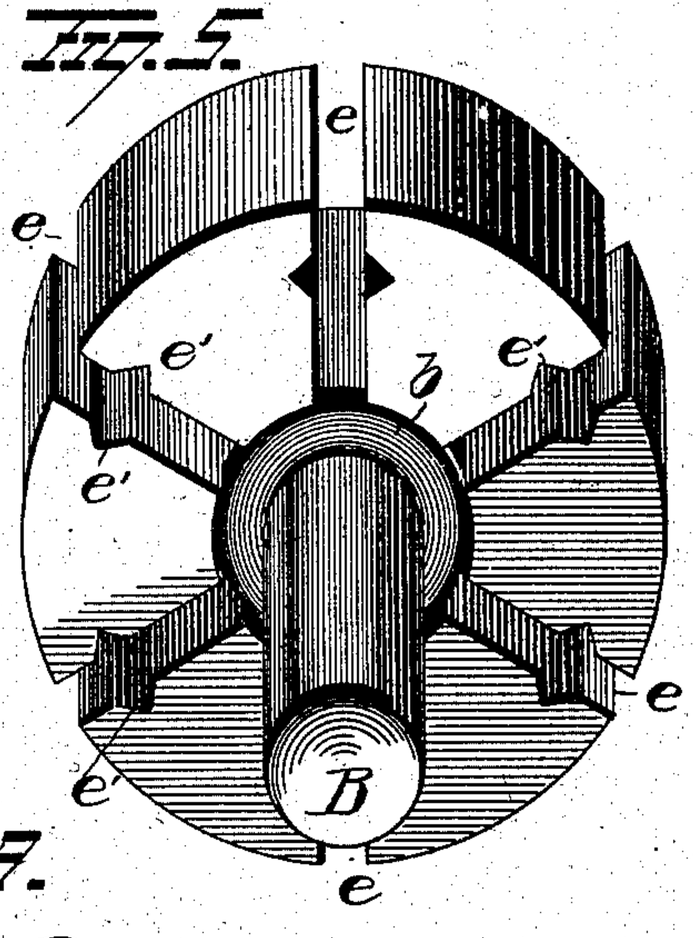


Fig. 9.

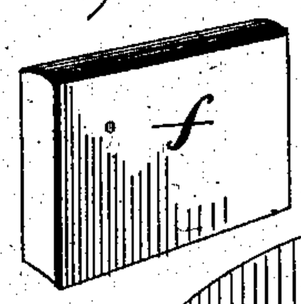


Fig. 7.

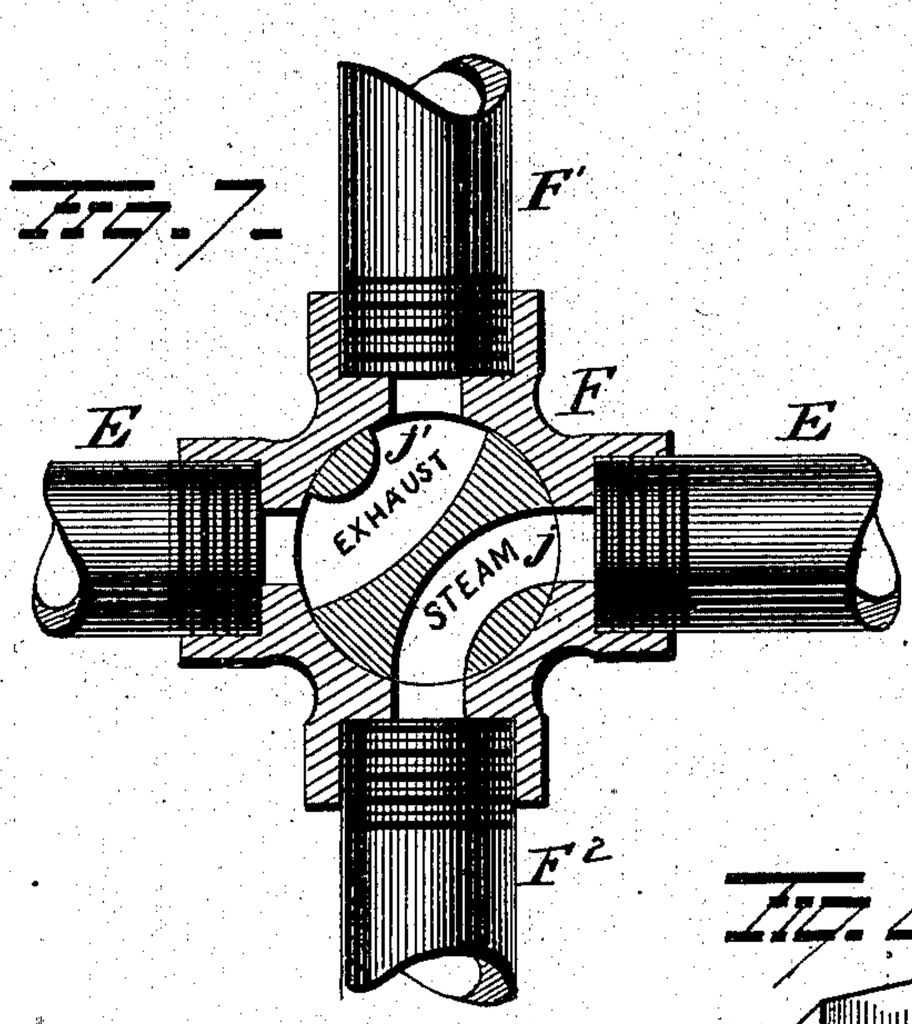


Fig. 10.

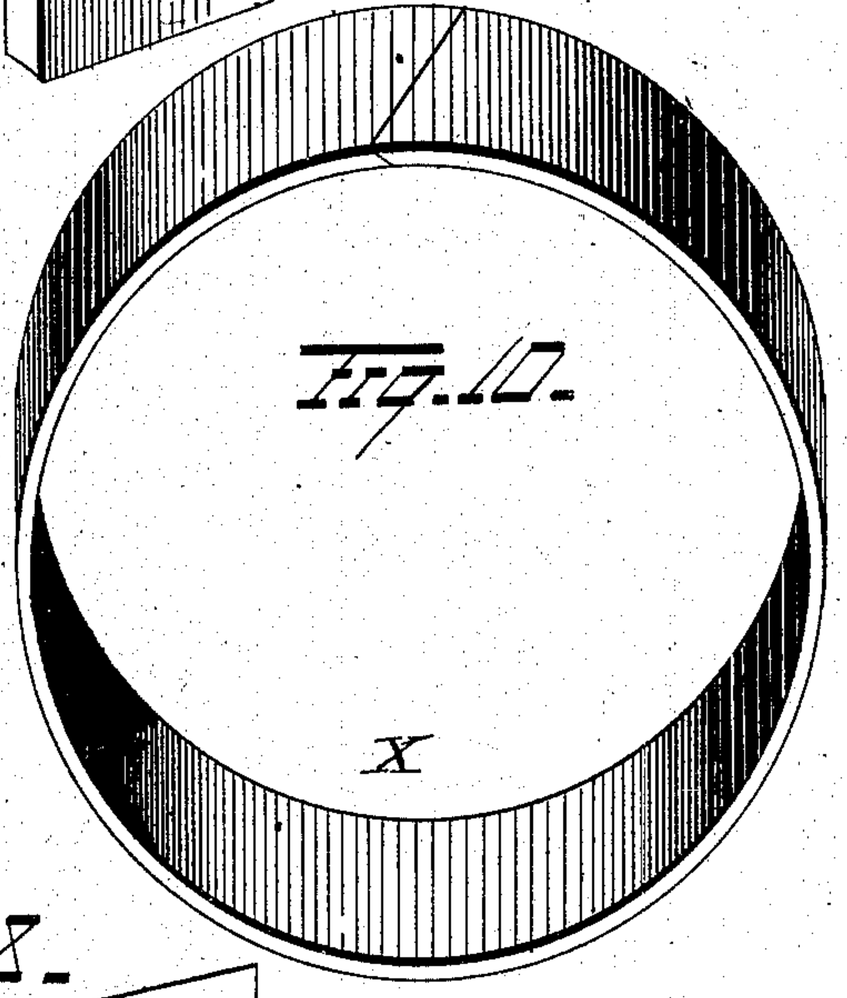
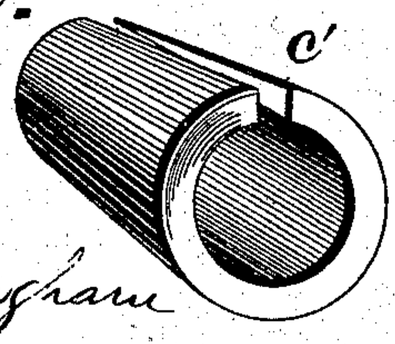
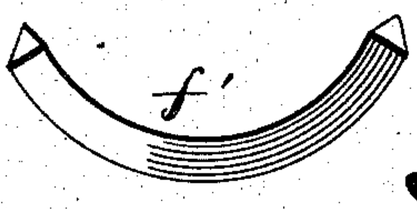


Fig. 8.

Fig. 6.





Witnesses
E. L. Nottingham
G. F. Downing.

Inventor
G. W. Soule.
By F. A. Seymour.
Attorney

UNITED STATES PATENT OFFICE.

GEORGE W. SOULÉ, OF MERIDIAN, MISSISSIPPI.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 560,760, dated May 26, 1896.

Application filed November 8, 1892. Renewed November 7, 1895. Serial No. 568,238. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. SOULÉ, of Meridian, in the county of Lauderdale and State of Mississippi, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in rotary engines, its object being to produce a rotary engine so constructed and arranged that it can be easily, quickly, and effectually reversed.

A further object is to provide a rotary engine having sliding wings or pistons, with means whereby said wings or pistons will be forced outwardly by the action of steam at a higher pressure and independent of the steam which drives the engine.

A further object is to construct a rotary engine in such manner that steam will be made to force the pistons or wings outwardly and so that the pipes which convey the steam to the center of the disk or head for this purpose will also serve to conduct lubricating material to the engine, whereby all parts thereof will be thoroughly lubricated.

A further object is to construct the engine in such manner that no frictional or steam load will be imposed upon the revolving disk or head.

A further object is to so construct the engine that the steam will be admitted at diametrically opposite points of the revolving disk or head, the devices for conducting the steam being so arranged that when the engine is running in one direction one device or pipe will conduct the steam to the revolving head or disk to drive it, and when running in the reverse direction said pipe will act as the exhaust, and vice versa.

A further object is to construct the engine-casing in such manner that the wings or pistons will have no movement in their slots in the revolution of the disk or head at the time there is steam-pressure against them.

A further object is to provide simple and efficient packing devices whereby to insure the proper operation of the revolving disk or head and the wings or pistons carried thereby.

A further object is to produce a rotary engine which shall be simple in construction, easy to manipulate, and effectual in the performance of its functions.

With these objects in view the invention consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation of my improved rotary engine. Fig. 2 is an end view. Fig. 3 is an end view with the head removed, some of the parts being shown in section. Figs. 4, 5, 6, 7, 8, and 9 are detail views. Fig. 10 is a separate view of the lining.

A represents the engine-casing, which is elliptical in form, the ends being concentric with a shaft B, which passes through the center of said casing, said shaft being supported in journal-bearings B′, carried by the heads C of the casing, said heads and the casing being secured together by means of suitable bolts *a*.

Secured to or made integral with the shaft B within the casing A is a revoluble head D, in each face of which, in close proximity to the shaft B, a recess *b* is made and adapted to communicate with slots *c*, which extend through the journal-bearings of the shaft B and through conical bushings *c′* in said journal-bearings. A bracket *d* projects outwardly from each head C and is provided with screw-threaded perforations for the accommodation of threaded bolts *d′*, which latter pass through perforations in the journal-bearings B′ and are adapted at their pointed or wedge-shaped lower ends e^2 to enter the slots *c* in the bushings *c′*, thus retaining said bushing in such position that the slots therein will be at the top of the journal-bearing for a purpose which will appear farther on. The bushings may be secured to the journal-bearings by means of nuts e^3.

The revoluble disk or head D is provided with a series of, preferably six or more, slots *e*, each of sufficient width and depth to receive a sliding wing or piston *f*. The walls of each slot are provided with V-shaped or other shaped grooves *e′*, in which similarly-shaped packing-strips e^4 are inserted. Both heads C of the casing are also made with V-

shaped or other shaped grooves for the reception of similarly-shaped packing strips or rings f'. Passing through the brackets d and journal-bearings B' and communicating with slots c are two pipes g g, which at their upper ends are connected together by means of a suitable coupling, said pipes g g being adapted to receive (in a manner hereinafter explained) steam independent of the steam which drives the engine. From this construction and arrangement of parts it will be seen that the steam which passes through the pipes g g will enter the grooves or slots c in the bushings c' and journal-bearings B', from which it will pass to the recesses b and finally against the inner ends of the pistons f, thus forcing said wings or pistons against the inner wall of the casing A. The escape of steam from the recesses or slots e behind the wings or pistons f will be prevented by the packing-strips e^4, which, by the pressure of the steam and centrifugal action, will be made to bear against the faces of the wings or pistons and one side of the grooves and prevent the escape of steam past them. The packing-rings f' are in a similar manner made to bear against the head D and one side of their grooves.

Made in the heads C of the engine are ports i i, arranged in proximity to the edge or periphery of said heads at diametrically opposite points, the ports in each head being adapted to communicate by means of ducts i'. With one of the ducts i' of each head C (preferably the upper one) a pipe E communicates, whereby to conduct steam through both ports in each head, the ports i in one head being arranged or located near one side of the engine in an oblique line with each other, while the ports i in the other head are arranged in the reverse position, so that steam passing through the upper port of one head C will drive the revoluble head D in one direction, and the steam passing through the diagonally opposite port of the same head C will drive said head D in the same direction at the same time.

When the engine is to be used as a reversible motor, the upper ends of the large steam-pipes E are each connected with a four-way valve F, said valve being provided with an exhaust F' and a steam-inlet pipe F^2. The duct j of the valve F, through which live steam is to pass, is made of a size preferably about the size of the bore of the pipe E, while the exhaust duct j' of said valve is made somewhat larger. In fact this exhaust-duct j' is made considerably larger than the live-steam port j, so that the exhaust may be open sooner and later than the live-steam port, whereby when it is desirable that the steam be partly shut off in either direction the exhaust will not be cramped.

From the construction and arrangement of the pipes E, ports i, ducts i', and valve F it will be readily seen that when steam is made to enter the engine through one of the pipes E it will exhaust through the other, and vice versa.

By means of the four-way valve F the steam may be made to enter either pipe E and exhaust through the other, according to the direction in which it is desired that the engine shall run. In like manner the engine may be easily and effectually reversed, either gradually or quickly, as desired, by simply manipulating the valve F, which may be done by means of an arm k, attached to the squared stem k' of the valve. The steam-inlet pipe F^2 is connected with the small steam-pipes g g by means of couplings l l' l^2, whereby steam will be permitted to pass through said small steam-pipes g g before it passes through the valve F, and thus the steam passing through said pipes g g and acting on the wings or pistons f, as above explained, will not be controlled by the valve F, but, on the contrary, will be entirely independent thereof. A lubricator G is connected with the coupling l' and is also connected with the steam-inlet pipe F^2 by means of a pipe n. From this construction it will be seen that not only the live steam, which maintains the pistons in proper position relatively to the inner walls of the casing, will pass through the pipes, but lubricating-oil will be made to flow from the lubricator G through said pipes g g and thus supply oil to the interior of the engine and thoroughly lubricate all the working parts therein in a thorough and effectual manner.

By making the opposite ends of the casing A concentric with the revolving head D the pistons f will have no movement in their slots in the revoluble head while they are subjected to the pressure of the steam.

In order to secure a smooth and durable wearing-surface within the casing A and to permit the removal of that surface should it wear, I provide a wearing-strip X of plate-steel within said casing. This wearing-strip consists of a straight strip of plate-steel of the same width as the case (the steel being first tempered and ground) and of the proper length to fit the inside circumference of the case. The ends of the strip are cut at an angle of about six degrees, and the strip being sprung into the case the ends are abutted for, say, half their width and then are forced in, the angle compelling the wearing strip or lining to spring out tightly against all parts of the case. Of course the heads when bolted to place will hold the lining firmly.

In rotary engines as they are commonly constructed the revoluble head is supposed to make a steam-tight connection with the casing at the nearest point to prevent the steam from passing back. I do away with this by using six or more pistons, the space between them being, of course, one-sixth of the circumference of the head, and I make the ports equal in length to one-twelfth of the circum-

ference of the head, thus bringing their ends in planes one-sixth of the circumference of the head apart. Thus there is always one piston between two of the ports, which prevents the passage of steam from one port to the other without carrying a piston with it. There being no necessity for the revoluble head to have a steam-tight connection with the casing, the shortest diameter of the casing is just sufficient to permit the head D to revolve freely, (not steam-tight,) and the two ends of the casing (which are modified ellipses) are segments of a circle concentric with the shaft of the engine, each being one-sixth of a complete circle or a part of a full circle divided by the number of pistons in the revoluble head.

The importance of my departure from previous common practice of using the eccentric form of a casing for a rotary engine and substituting therefor the ellipse is that the using the steam equally and simultaneously above and below the revoluble head or runner arises from the fact that this gives a balanced steam-pressure on the revoluble head or runner and eliminates journal load and consequent friction. Supposing that the steam was used on one side only, there would be a steam-pressure due to the cross-sectional area of the revoluble head multiplied by the steam-pressure to be resisted by the journals—a pressure greater by many times than that which was available for work.

The ports *i* in the heads C of the engine are duplicates; but it is manifest that in reversing the ports will occupy different positions—that is to say, at one time or when the engine is running in one direction the ports *i* of one head C will be inlet-ports and when running in the reverse direction said ports (which were formerly inlet-ports) will be exhaust-ports, as above alluded to. This difference of position amounts to exactly one-sixth of a revolution when six pistons are used, and as the ports are one-twelfth of a revolution long it is manifest that in the close part of the casing A it will always be one-sixth of a revolution also between the smaller end of the ports in one head to the smaller end of the contiguous port in the other. Thus there is always one piston between two of the ports, which does away with the need of the revoluble head making a steam-tight joint with the casing A. As the ports of each head C are connected together by a duct or passage, the steam will enter the casing above and below the revoluble head D equally and in unison. The ports *i* may, if desired, be located in the casing A instead of the heads C.

The journal-bearings B′ are provided externally with screw-threads for the reception of stuffing-boxes, which comprise collars *o* and follower *o′*, and between the former and the metal conical bushing *c′* flexible or other packing is preferably employed.

My improved engine is a very simple substantial rotary motor. It possesses no complicated valve-gearing and no exposed parts subject to destruction by dust and grit. When used as a reversible motor, it runs exactly the same one way as the other and is controlled by one handle attached to a simple four-way valve.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a rotary engine, the combination with a shaft, a casing two heads and journal-bearings carried by said heads, said journal-bearings having grooves therein, of a bushing in each journal-bearing, having a slot therein, a revoluble head having slots, carried by the shaft, said revoluble head having recesses adjacent to the shaft adapted to communicate with the grooves in the journal-bearings, wings or pistons in the slots in the revoluble head, pipes communicating with the slots in the bushings, and means for injecting steam through said pipes to the center of the revoluble head and against the inner ends of the wings or pistons, substantially as set forth.

2. In a rotary engine, the combination with a casing, its ends, a shaft and journal-bearings for said shaft, of a slotted bushing in each journal-bearing, a bracket projecting from each head, a screw passing through each bracket and a perforation in the journal-bearings and entering the slots in the bushings to retain said slot at the top of the bearing, a revoluble head carried by said shaft and having recesses to communicate with the slotted bushings, wings or pistons carried by said revoluble head, and pipes communicating with said slotted bushings, whereby steam will be transmitted to the center of the revoluble head to force the wings or pistons outwardly, substantially as set forth.

3. In a rotary engine, the combination with a casing, its ends, a shaft and journal-bearings for said shaft, of a slotted bushing in said journal-bearing adapted to communicate with grooves in said journal bearings, a bracket projecting from each head, a screw passing through each bracket and perforations in the journal-bearings, and adapted to enter the slotted bushings, a revoluble head carried by said shaft and having recesses to communicate with the grooves in the journal-bearings, wings or pistons carried by said revoluble head, and pipes communicating with said slotted bushings, substantially as set forth.

4. In a rotary engine, the combination with a casing, its head, a shaft and journal-bearings for said shaft, of a slotted bushing in each journal-bearing adapted to communicate with grooves in the journal-bearings, a bracket projecting from each head, a screw passing through each bracket and perforations in the journal-bearings, nuts on said screws adapted to bear against the journal-bearings and brackets, a wedge at the lower end of each screw and adapted to enter the slotted bushings, a revoluble head carried by

said shaft and having a recess to communicate with the recesses in the journal-bearings, wings or pistons carried by said revoluble head, and steam-pipes communicating with said slotted bushings, substantially as set forth.

5. In a rotary engine, the combination with a casing and its heads, of a shaft, a revoluble head carried by said shaft, said revoluble shaft having six slots, a wing or piston in each slot, the space between said wings or pistons being equal to one-sixth of a revolution of the revoluble head, steam-ports in the heads of the casing arranged apart a distance equal to one-sixth of the circumference of the revoluble head and each of a length equal to one-twelfth of the circumference of said revoluble head, whereby there will always be a wing or piston between two of the ports so that the passage of steam from one port to another without carrying a wing or piston with it, will be prevented, substantially as set forth.

6. In a rotary engine, the combination with a casing, its ends or heads, a shaft, and journal-bearings for said shaft, of a slotted bushing in said journal-bearings, the latter having a perforation, a device passing through the perforation in each journal-bearing and entering a slot in the bushing to retain said slot at the top of the bearing, a revoluble head or runner carried by said shaft and having recesses to communicate with the slotted bushings, wings or pistons carried by said revoluble head or runner, and pipes communicating with said slotted bushings whereby steam will be transmitted to the center of the revoluble head or runner to force the wings or pistons outwardly, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

GEORGE W. SOULÉ.

Witnesses:
T. J. TURNER,
T. H. STUCKEY.